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(54) METHOD OF TREATMENT OF TOOTH HARD TISSUES BY LASER
RADIATION AND DEVICE FOR ITS REALIZATION

(57) Abstract:

FIELD: medical equipment, applicable in stomatology at treatment of caries and dental prosthetics. SUBSTANCE: the method consists in action of laser pulse on the tooth tissue, acoustic pulse arising at interaction of radiation with the tissue is detected, and the type of the tissue to be treated is determined according to the pulse peak amplitude. The device uses a pulsed laser and means for delivery of radiation from the laser to the tooth arranged in succession from the laser to the tooth arranged in succession in the optimal axis; the input of the means of radiation delivery is optically integrated with the laser output, has an acoustic pickup and an electric pulse peak amplitude meter, whose input is electrically coupled to the acoustic pickup output, and the output is electrically coupled to the display unit input; the acoustic pickup is installed in such a manner that the direction of its maximum sensitivity makes up angle α with the direction of the optical axis at the output of the radiation delivery means, this angle satisfies condition: $11^\circ < \alpha < 46^\circ$. EFFECT: reduced danger of laser injury to patient. 6 cl, 5 dwgr

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(51) Int. Cl: A6105/00 A61N5/06

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1. Harem^s CILIA N 4521194. Kn. A 61 C 5/00, 1986. 2. ABTopcKoe CBHACTCnbCTBO CCCP N 1593669, Kn. A 61 C 5/00, 1990. 3. WO, naTeHT, 89/08432, Kn. A 61 C 5/00, 1989. 4. WO, naTeHT, 90/01907, Kn. A 61 C 5/00, 1989.

(71) Applicant: YL^{ie6}Ho-Hay^YHo-npoH3BOJ;cTBeHHbILL "J1a3epmbII ueHTp" I4HCTHTyTa TO⁴HOL McXaHHKH H OHTHKH

(72) Inventor: AnbTIuyneP I.B., BenHKoB A.B., Epo4ieen A.B., AnbTnryneP I.B., BeJIHKOB A.B., Epocpeen A.B.,

(73) Proprietor: Yue⁶HO-Hay^YHo-npoH3BOJ;cTBeHHbI2 "Ha3epHbiti ueHTp" MHCTHTyTa TO⁴HO2 McXaHHKH 11 OHTHKH

(54) СИОСОВ ОВРАБОТКИ4 ТВЕРДЫХ ТКАНЕЙ 3YBA JIA3EPHbIM
143JIY¹IEHI4EM 14 YCTPOLICTBO JIJI51 ErO OCYli(ECTBJIEHYI5I

(57) Abstract:

143o6peTenne OTHOCHTCH K MeHHIH4HCKOLI TCXHHKe H MO²KCT 6bITb BCHOnb3OBaHO B CTOMaT0M0PHH npa negeHHH Kapaeca B HpOTe3HpOBaHHH 3y60B. OCHOBHbIM HeJ; OCTaTKOM 143BCCTHbIX СНОCO60B 06pa6OTKH TBepJjbIX TKAHeH 3y6a na3epHbIM B3nyHeHHeM B ycTpoilcTB, peanH3yion4Hx 3TH CnoC06bI, HBnHCTCH BbICOKaSI OnaCHOCTb HaHeCeHHH na3epnoi TpaBMbi nau eHTy. Llenblo H306peTeHHSi HBnHeTCH CHHIKeHHe OnaCHOCTH HaHeceHHSI nauieHTy na3epuofl TpaHMbI 3a c¹leT obecneueHHH B03MO²KHOCTH onpege nem THna o6ra6amiaMOi TKaHH. YKa3anHasi Ijenb J;ocTHrae'rcsi -rem, ¹ITO B спосоbe 06pa6OTKH TBCpgbIX TKaiel/I 3y6a na3epHbIM H3nyueHHeM, HKnIO¹laionjeM B031telaeTBHe Ha TKaHH 3y6a na3epHOrO HMnynbCa, perHCTpupyoT aKyCTH¹leCKH11 HMIlynb, B03HiiKaI0114HLI HpH B3aHMOJ;eiICTBHH H3ny¹leHHSI c TKaIIbiO, no HHKOBOLI aMIIfHTy/de KOTOpoO onpege nHIOT THH o6ra6amiaBaemoi TKaHH. YKa3aHHasI ikenb TaK?Ke J(ocTHraeTcH 'rem, ¹ITO ycTpo2CTBO JjnH o6ra6OTKH TBepJjb1X TKaHeiI 3y6a na3epHbIM v13nyuenleM, COCT051I ee 113 noCneJIOBaTenbHO paCnonoKeHHbIX B) Onb OnTH¹leCKOii OCH HMriynbCHOrO na3epa H cpej cTba gOCTaBKH LI3ny¹leHHSi OT na3epa K 3y6y, BXOJ| KOTOpoO 01TH¹leCKH conpSui eii c BbIXO) OM na3epa, COgep²KHT aKyCTH¹leCKH11 npHeMHHK H B3MepHTenb HHKOBON aMIUIITygbI 311eKTpII4eCKHX HMHynbCOB, BXOJ; KOTOpoO 3neKTpH¹leCKH COnpH²KeH c BbIXOgOM aKyCTH¹leCKOro npHeMHHKa, a BbIXOJj 3nCKTpH¹leCKH COHpH²KeH co BXOJ(OM yCTpOiiCTBa 1/iiJ;HKaI1¹Hi/1, npH¹leM aKyCTH¹leCK1I1 npHeMHHK yc'raHOBneH TaKBM o6pa30M, ¹ITO HanpaBneHHe ero MaKCYIManbHO2 ¹lyBCTBHTenbHOCTLI COCTaBnHeT c HanpauneHHeM OHTHLLieCKO12 ocm Ha BbIXOgC Cpe);CTBa AOCTaBKH H3ny⁴lCH145I OT na3epa K 3y6y yrOn a, yJlOBneTBOPhlo i4I ycnoBHlo: >.i° < d < **86**. 2 c. H 4 3.114-nbl, 5 rm.

Description [Onncautie H3o6peTeHJst]:

I/13o6peTeaue **OTHOCHTCH** K **McJ(HIWHCKOi1 TeXHHKe H** MO?KeT **6bITb HСПОJb30BanO** B cToMaTonornH npH ne⁴еHHH KapHeca H npOTC3HpOBaHHLI 3y6o.

I/13BeCTeH cnoco6 **yjaneHHH xauanbHbIx KapHO31lb1X UOBpe2KJjeHHi1 H/HJIH** KaMHei1 3y6a (naTeHT USA 4521194, A 61 C 5/00, npHOpHTeT **22.12.83 r.**), **BKnlotlalonglil** обрабоTКу **TBepJ;blIX TKaHCii** 3y6a **HMnynbCHbIM** na3epHbIM 113nyueHHCM. **ОСНОВНЫМ** HeX(OCTaTKOM **J;aHHOrO** спосоbа **HBnHeTCH** **BbICOKaH** OnacnocTb HaneCeHHH na3epaoil TpaBMbl npH обрабоTKe **TBepJ1b1X** TKaHeil 3y6a.

Han6onee 6II 3KHM no TeXHH 'leCKOII c u **IOCTH H npMHHTbIM** 3a **npOTOTHn** **HBnHCTCH** cnoco6 neueHHH HeOCnO)KHeHHOrO xapneca (a. c. **CCCP** N 1593669. A 61 C 5/00, npHOpHTeT 14.11.85 r. ony6n. 23.09.90 r. B14 N 35), **BKnloalIOH10** o6pa6oTKy **TBCp>ibIX** TKaHei1 3y6a na3epHbIM **B37IyueHHCM** c **JjfHHOLI BOJb1 2,94 MKM**. JpiwTeni,HOCTb1O HMnyJbCOB **100-500** MKC, **MOHNOCTbIO** 0,5-1,0 J12K/HMn, **IUIOTHOCTbIO** MOU **ROCTH** $2 \cdot 10^{4+} 3 \cdot 10$ BT/CM², uacToToii 1 1'ij, **3KCH03HIMCII** 3-30 c. **ОСНОВНЫМ** **HegOCTaTKOM** **TIpOTOTHn** **HBnneTCH** **OnaCHOCTb** **HaHeCCHHH** na3epHOYi TpaBMbl npH обрабоTKe TKaBCl1 3y6a, **CBH3aHHan** c oTCyTCTBHCm B npoTOTHnC npolterupbI **Onpej;eneHnSI** THna обрабаTBIBaeMOY1 TKaHH.

I/13neeTHe **yCTpONCTBO** J;nH 06pa6oTKH TBC) blx TKaHCi1 3y6a na3epHbIM n3nyue1n4eM (naTeHT WO 89/08432, A 61 C 5/00, npHOpHTCT 10.03.89 r.), **BKnno^galonkee** nocneJ(ouaTenbno pacnono}KeHHble **BJIOnb OUTH** 'leCKO\$ OCH HM1lynbCHbI\$ na3ep H cpeJICTBO **,HOCTaBKH** 143ny 'ICHHH K 3y6y B BHJie OITH¹ 'leCKOrO BOJOKHa. **ОСНОВНЫМ** **HCJIOCTaTKOM** **JjaHHOrO** **yCTpOLICTBa** **HBnHeTCH** **BbICOKaR** onacnoc'rB **HaHCeHHH** na3epHOYi TpaBMbl npH обрабоTKe **TBep;gbIX** TKaHei1 3y6a.

Han6onee 6JIH3KHM no TeXHHUeCKoii CyUIHOCTH H npHHHTbIM 3a **PrOTOTHII BBf\$ICTCH** **yCTpOLICTBO** gym обрабоTKn TBepJ1bIX TKaHei1 3y6a na3epHbIM **H37IyueHHeM** (na'renT WO 90/01907. A 61 C 5/00, npWOpHTeT 25.08.89 r.), **cogepxtatnee** **IocneJSonaTej1bHo** pacnono}KeHHbie BJJonb onTHUecxoit OcH **HMfynbCHbI2** na3ep H cpeJlCtBO JjOCTaBKH H3nyueHHB K 3y6y, **BKnloalIcuI** ee OTpe3oK OHTH¹ 'leCKOrO **BOJOKHa, BKOJj KOTOOpOr0** OBTvi ieCKH c0npH?KeH C BbixonoM na3epa, vi **HaKOHC¹IHHK, BKOJi KOTOOpOrO** onTHUecKH **conpn2Kelt** c BbiXO) OM OHTHUCCKOrO BOJOKHa, a **BbIXOJ(HBnHCTCH** BbixonoM ycTpovlcTba. **OCHonnbIM** **HC** **OCTaTKOM** npOTOTHnA **HBnHCTCH** onacHocTb **HaHeCeHHH** na3epHo i TpaBMbl npn обрабоTKe TKaneL1 3y6a, cBH3aHHan c oTCyTcTBHeM B npOTOTHnE CHCTeMbl onpegeHHH T1/Ina обрабаминеioi TKaHH.

3aJjaueii, **Ha pemeHHe** KoTopoia Hanpanneno 3annnHeMoe H3O6peTeHne, HBnneTcH CHvoKeHVte onaciocTB HaHeceHnn nai vleuTy na3epHoii TpaBMbi 3a cueT обеспeueHHH BO3MO?KHOCTII onpej;enein5 THna обрабаTBIBaeMoi TKaHH.

YKa3aviHas 3a) aua j ocTnraeTcn TeM, wTo B спосоbе обрабоTKH TBep) bIX TKaHei1 3y6a na3epHbIM **H3JLyueHHeM**, BKJHoualou;eM BO3) eiiCTBHe Ha TKaHH 3y6a na3CpHOrO HMnynbCa, perucTpivpiyioT aKyCTHUCCKHii HMnynbC, BO3HHKalonjLn\$ npH B3anmoneilcTBHH H3ny 'leHHH c TKaHbIO, no nuKo8o1i aMIUIHTy) a KoToporo onpegem noT THn обрабаTBIBaeMOLI TKaHH. **AnH HOBBImCHHH J;OCTOBepHOCTH** **OnpeJleneHHH** THna обрабаTBIBaeMOi1 TKaHH yKa3aIHb1iI aKycTH 'leCKHli HM1lynbC perHCTpHpylOT B J;Hana30He 3ByKOBBIX 'iaCTOT 85-95 Kl'g. C TOLL ?KC U,ebnIO o) **HOBpeMeHHO** c perHCTpall,Heii aKyCTHueCKOrO **HMIlyYibCa** **H3MCpHIOT** BpCMCHHyIO 3agepnKKy Me?Kpy na3epHbIM H aKyCTH¹ 'leCKHm **HMIlynbcaMH**, nO BenHUHHe KOTOOpOli yTO¹ nIHJiO TTHn обрабаTBIBaeMOi1 TKaHH.

YKa3aHHa5 3aJ;aua TaK?Ke JjOCTHraeTen TCM, 4TO ycTpoilcTBO J>nH обрабоTKH TBep);bIX TKaHei1 3y6a na3epHbIM n3JIyuerneM, cocTo5In ee H3 HOCneJ(OBaTeJ1bHO pacnono?KeHHb1X BJ;Onb OHTHueCKOi1 OCH HM1lynbCHOrO na3epa H Cpeg;CTBa JIOTaBKH H31ly 'leHH51 OT na3epa K 3y6y, BKOJj KOTOOpOrO OHTHueCKH COnpH?KCH c BbIXOgOM na3epa, COJ;ep?KHT aKyCTH 'leCKHli npHeMHHK H H3MepLTeJlb nIKOBOi1 aMnnHTyJ(bI 3nCKTpH 'leCKYIX **HMIlynbCOB**, BKOJj KOTOOpOro oneKTpuneCKAi conpH?KeH Co BKOJ;OM yCTpOLICTBa HHJIHKaUHH, npHUeM aKycTnueCKHi4 nplleMHHK ycTaHOBneH TaKHM Obrap3oM, 'ITO HanpaBneHHe ero

WLIrEj, •(91 IH1) IIUEWE HHHarHAd \mathcal{L} Ed Hdu oaallIOIE \mathcal{L} HH \mathcal{L} Oa 'Ea4Is&o a o.1o3133hHJ3A31f I'U1AL11HHH~IE LIOao iau J.O Hal,3'ehaU.LO (cad ox"IUOxoA H a) OHHa.a.L 311Ic3 (Ej.IH(~) EHHJ.Ha11 HHHanalid \mathcal{L} Ed Hdu O.Iatuo1ExHH \mathcal{L} Oa 'Ea \mathcal{L} iAUWH 0.I01103h14JaAxE 'ellk LIUH \mathcal{L} ue (EEH4LfewmaxEW) ISEHOxuu o.Lh 'OHE \mathcal{L} ExOU OH \mathcal{L} ured,HaWHdauaxe HWEdo,Lav •aoa41IAuwu x11xaahHJ 3 ME WExH.LOHda,Lxaclax ou (HH.LH31Y 4UEWE) HHELL 9oN32a14.LE9Ed90 uH L 4j EHODa4a4 J HaltH store IEultadu I4do,Lau WaHHahttU \mathcal{L} H WI \mathcal{L} ndafELI E9.&L HaHEx.L xl \mathcal{L} ltdaaa, ax.Loged90 Hdu A.LH3I4I U laKaEd.L K11I1333HEH H.LOOH3ELIO ISHHDIINH31-140 ISUT(

•au \mathcal{L} uAu x EHHJ.Ha11 of LLOO \mathcal{L} HUG L_IoH1laajaltad3ouaH IS3.LaISH3I54.90 O.Lh '(WOJodou ItaH HHudaxe HJaOH.LOLILI aYIHanllgaadu aol.LEdxu.LISu 4nu4II oI \mathcal{L} I.H.I3Au0): •3(L) axr-A aoalta ondaWHdu HO \mathcal{L} EEUEAIt I114HoE110 \mathcal{L} 39 EHH.LHalt mutt 'ISHHau1/td \mathcal{L} Ed noaadou Iftu KHHahAu \mathcal{L} H alouda \mathcal{L} EU 'madam HJaohJAL[II aauamII4aadu 3oH.L'ed3I.H.LK331 IS3.L3ISLIHIS WI4WHLA~II0I HUEMIE I5001 'ISHHah~u \mathcal{L} H HH.Id3HE H.1,30H.L0III HHHahEH \mathcal{L} HO \mathcal{L} EEUEHIt '89A \mathcal{L} n1L,09'ed90 LIOHda \mathcal{L} EU I4dA nodu HJa0H3E110 \mathcal{L} 39 KHHad \mathcal{L} Hxho,L j14WauWaadu 4J.Haislga HUHII \mathcal{L} Oa \mathcal{L} OU ({}jj •d ,z661 3au3i39 a*[-j ui uonuaTiddy SaSE-j uo aaua.Ia;uo3 IEUOfEUJa}uj 'U1p33301d ,uoj}ESnp }ua.Iajjp Jo sasind .IasuL Lpj \mathcal{L} sans!} moo} pxeq Jo EEUIEp 3%1, AaaJO.Ig•A•d 'AOI \mathcal{L} ag•A•d • 13 \mathcal{L} 11V'H'9) E9A \mathcal{L} gamma, xt4ltada L Hx.Lo9Ed90 aoWH az d 1SHHEaoltar3aa aI \mathcal{L} IT \mathcal{L} u'exuaWHdauaxc HWEdoJ.aE al4HHaltaodj •ISHHaUTAdcEd E.lodou W3HHahEH \mathcal{L} 1tEH '4HEx.L ouinaEai4J,E9Ed90 EH OJahloreltau 'ISHHahAL \mathcal{L} H HH.Idae HHHauiIlgadu 14OH9LC31,11hEH \mathcal{L} Hdu WHIUOIE \mathcal{L} Hx \mathcal{L} Oa •HhEl1.1.0 WoagUAIWLI HaHE3J. ISH \mathcal{L} AJ.HOI Haj,alSIIHIS Ex3Hd WOdoi,xEij rumlaoHap •HHJ.HaI EH JaEllEuoou HUEWe ISHHanIAd \mathcal{L} Ed.Iodou IlatnolElulgadu 'Iiwh.IdhHE 3 3HH3hAu \mathcal{L} H 3OH3gUAuWH H1133 °3ahA113 WoL a I4uquuu HUH EHHJ.H3It I \mathcal{L} WfEdj. HOHda \mathcal{L} EU UHH333HEH 0I \mathcal{L} LooH3E110 3 EH}KISDUO3 E9A \mathcal{L} L1aHEXj xi \mathcal{L} 1daaj. HMJ,o9Edg0 L_IoHda \mathcal{L} EU EdRtahodu WoJ a Hdj1 •Hx.LO9Ed90 aaaanlodu a oxx3aj,3113d3ou3H FIHJ.Ha11 HUH TUEW6 EH aHHah/LL \mathcal{L} H J.3AaLox4 11 \mathcal{L} Oa 4J.HUaltadu0 HHHISO,L003 a 311 hEda 'HWEaoUr 11W1dJAdit •EUHJ, as 3HH3L 3113dI0 H HHEHJ. H.LOOHxadao II01'13EhAu90 HHHHOJ.003 4UOd.LHOx Iu'ui4UEA \mathcal{L} Ha Puammoy \mathcal{L} oaaH J,aEUalt OJ.h 113HE(H14HHoa \mathcal{L} ode J,aEnHH \mathcal{L} Oa HJ.30Hxd3aou HOWamalsue9Ed90 EH I II3hAu \mathcal{L} H WI \mathcal{L} Hda \mathcal{L} Eu EgA \mathcal{L} I13HEMj, x1 \mathcal{L} 1daaj,L ax.Lo9Edgo Hdj1 '11UEWE ISHHauIAd \mathcal{L} Ed uodou Wah 'axcH HHHJ.Ha1t ISHharnSd \mathcal{L} Ed uodou Wahadu 'fEd Ox4UOx33H a ISaLOIeH \mathcal{L} Hu \mathcal{L} Ed WaHHahAU \mathcal{L} H WI4Hda \mathcal{L} EU II3HEMj. XH.LE ISHHanIxd \mathcal{L} Ed H.Iodoj1•H1LLH31t H MIME IS3J.I53OHJ,O E91C \mathcal{L} WKHEM.L WI4ltada.L x 'OHJ.aaa \mathcal{L} H xE;j

I4uAWd0~I cal ou Egoaoua HHhE \mathcal{L} Huaad mitt ISHHa.Ladgo \mathcal{L} H I \mathcal{L} ulcWdotj 9'11 011 Eaj.aliodJaLL. EW3X3 EHE \mathcal{L} ESIOU 9 •.IH1 EH °I4uAWdocl) vui ou Egoa0Ua mMtrecnuad mutt I \mathcal{L} uAWdo4) •u ou Eai3 odJaA EWaxa EHE \mathcal{L} Exou vamp EH •gUAWdo4) j u ou E9o3oua HH IE \mathcal{L} HUEad gulf H14HaLad9O \mathcal{L} H I4u1Wd04 ii•u ou EajaHod. oA EWaxa EHE \mathcal{L} EMOU 9J114) Ej1 •(I) MIMIC H (a) EHHJ.H311 x unanad \mathcal{L} Ed Hdu xITHO!ExHH \mathcal{L} Oa 'ao3gUAuNH XHx33hHJaAME axores. E '4Jaouxdaon ofAWaEaI4J.Eged90 EH oaahIOIE1tEu 'unHahALI \mathcal{L} H oJOHda \mathcal{L} EEII HIL1d3HE HJOOHJ.OIII (9) •E34fAUWH OsIOHda \mathcal{L} EU HJaohHH3H3J.HH (E) :g \mathcal{L} 1^IIZEd.IEH11 31 \mathcal{L} LHHw1'13da IgUE \mathcal{L} Exou Hx33hILLEW3X3 Z'.IH4I EH •HuaN6 H EHH.LHa1t HHHauiIAd \mathcal{L} Ed WoHda \mathcal{L} EU HdIL f4L1110IEMH \mathcal{L} Oa 'ao3quAH1111 X113133h.H.LZAME ISHHaumouJ.O gJa0WH3HaE \mathcal{L} UEH4uad.Lxaua (al 'mums HHHaniAd \mathcal{L} Ed Wouda \mathcal{L} EU Hdu IlnhloixrH \mathcal{L} Oa '34UAIHKu L!Hx33hJ3 3E (9) 'EIWLHalf HH11au1Ad \mathcal{L} Ed Wouda \mathcal{L} EU 11du IIH1u0IE \mathcal{L} Hx \mathcal{L} Oa '34UAIWH HH3133hHJaAxE (E) :If1Ell j •.IH4 Ej1

eaLa#odLaA Woltoxa o3 HaxC1sduo0 Hxaahld.Lxaue iioxi \mathcal{L} g a E °E Ixnn xldu 010x3ahx! L3 LE WOltol4a a Hax {Uduoo IIM331 4da,xaue o.Iodo.LOx Itoxa IIodoi.a 'aouaadJ.HH x14HHaPIada ISx13daW \mathcal{L} H E310119 aOVOXa \mathcal{L} H WLUI10 3 H33KE'duo HxaahHd,Lxaue Itox14a E 'Eda \mathcal{L} EU Wo110XIga 3 Haxusduoa Hx3ahIIJ.uO Edo.LEda,muladoL.O4 11oxa Wahudu 'aoilaada.LHH x14HHaWada I mlladaW \mathcal{L} E)10U9 H doJ edJax.Iadoj.041 J. I daIoa OH4ua.LHHUOUOIt OHJauodJ.3 oi \mathcal{L} H axc L[O]. 3 °1J31 96-99 HHHExaAuodu vO3ouOu a HHhEd..4uH4 H HHHEao \mathcal{L} Edgoadu oJOHau dL.xau3 xou'9 Eadah 'exfullaxdu OJ03133hHJaAHE WOltol4a 3 HaxChduoo LlxaaxdJ,xuae aoaamCuwH xHx3ahudJ.xuae I9ItAL11UUWE IIoaoxHU KUaj.HdaW \mathcal{L} H 1toxa HHEx.L !OPaESI4J.EgEd9a Eu11J, amHaLt3 tadou 11J3OHd3aOL3Olt HYIH3UI4aOu Hlltt \mathcal{L} 88 8 oTT :0114a0113A III1uolHdoaa,auao1(A °3 Uoa& A91i \mathcal{L} x Eda \mathcal{L} EU .1.0 ISHHahAII \mathcal{L} H HxuEJaolt EaJaltad3 al(OXi4a EH 1130 II03133h11J.uO 1+13LIH311HEdUEH 3 .1.3111138 ,1303 H.L3OH4113.LHHJ.313Ah II0H911EW143MEW

N o 1oxlge 3 Haxcuduo3 11xa0h11dJ,xuae o,Iodoa.ox 11oxe '9 H034uICuNL1 XH3133h11d.1,31au6
 14tfIC.I:Hsum i oaoxnuu aUa.LUdaNi£H o⁹⁸ > p > OTT :omaouaA L[H11lOludo,air iotfA
 '10 uowitcg~C£ x EdafEU LO KnHah/Cu£i 11xeEJaolf aj,o 1ada attoxl4E EH Ho0 HOxaahH.LUO
 N1311HaIc1EdIIEH 3 .La15uuE.L303 11J ouo^gI J,HHJ,oaAI1 11OH4uENIH3xENI DJ3 auHauEduEH O.Lh
 '11I0fEd90 NIHxEL 11I'uJH3u&0H31.L3IC '9 MHHNloHdu |||11x3ahHJ,aicx E '7 xHHhaHOMEH H £ OH3OICOe
 30113ahIJ,JO 33110I1EhOlu5le 'EdafEU NIOffoxlga a Haxcuduo HxaahFJ,uo o,Iodo3Ax t'OXF 'Z d9/C£
 x EdafEU J,o UHHalUCu£H o.IoxdafEu LixaEJaoll oaJatiada 'j da£EU i41IE£enou adL(IH EH
 'v.111j) EH EHaua^y, atiadiu o lodo.Lox ENtaxa 31uJaLlodJ.a/C ol\$Houw a 'daNludu1H unaofHuead
 4.LJ^gg LaxcoN 1s3HaLad9o£H ieu4c do4 Z'11 ou goaoua Ll'makUeKEc •L 1111tIExifHH
 E1J,oIcodj,oA Nlloffoxo Oa Haxc1Sduo3 113133hMd.L313116 tfoxz a '313HHi4alldu oJ0313ahIJa/CME
 Nlloffoxia 3 Hawnduo a xxaanud.Lxae o,Iodoxox 1(oxa '9 ao3'a CUNIH XH3133nMd.L313ue
 I4tf/LHUIINI31 H0130x11u 4uaJ,ndaNi£H o⁹⁸ > p > OTT ornaoua& biutnoi3doaa.auaotLC p 110J1C
 d94C£ 31 Edaf31u J.o unHah1CU£H 11xe31Jaot1 Eejatfada atfoxige nu moo HoxaahHJ,Uo
 N13H11auaEd]IEH a J,3KU1131L303 HJ,oOH4u3.L14HJ,3EIsh LIOH4f31'113MEN1 OJ3 3HHa116EduEH
 OJ,h 'N10fEdgo NIHx31J, HU^gHH3IfaOHEJ,o1C 'g 3 UHN 31du v111xaahH L3 cM31 'j, MHHh3HOMEH
 ll 0131011011 a0313ah11J,u0 331U0I31hOlU31e '31da£31u NIO11OXH11 a Haxcisduo a H3133h11J,110
 o iodo.Lox lfoxa 'g IC9/C£ x 31da£311,Lo 1SUHahiCuf14 o,IOHda£EU 113113E.10011' off Latlada 'j da£EU
 14HE£313lou ad1Lng1 EH 'g'JR(EH EHaiHEJatiadU ouodo.Lox 3111'13C3 'naa,aHodJ,aiC oninoNou
 a 'daNiadunn Huaof111lead 4J,I4g J.axcow icnHaJ,ad9O£H 'g'ufNdo4) ru on 9030113 HIgHHal(QISEC

„IH3E10d1C 9143134I13J,31 L3d90f11,,
 owdaJ,ndx J,ando L311HOfA aaHa11Iad 303133h11X3J, 0111E3 E 1qOH0H IsA,l HLMIS
 HoxnH£Hdu K11H3J,ad90£H au1CN[do4 H XIquu3xcoU£Li q,1,aoHUCM080a aodoj.an PI SULiatfaea Oj1

'11H31nJ,)JONIanaIsue9Ed90 EU11J, 1.114H31h1o.LA gJ.30HMMON1foe J,31SUHE1a011bdu
 Eo34u1C111I14 X11313ahnioAnE xaxcdatnf Xi4Hllawada anHadaNi£H '11ofEd90 1HxnJ,
 (1) H11H3116 H11H311L d£Ed nth' Ll1p01EMH£oH '34IfA1NIH HHxa3hHJ,3AME l'13h 'Ea4u/CIIni11
 OJOHda£EU EI1EhEH oH^gu3J,H3oHJ o dx3cd3t3£ ouCIU4naw swarm nuHalmideud
 11du I3II1II0IEIHH£Oe 'o^gudlu'U 911313ah11J 31(313 OJh '01&1111 .1Hg'.1114 CH '31HLJ,1131
 H 111131116 n'na mend Ni3J0dOU a1IIIoufaxa.LaaJAoA '11HJd3He 11J,00HJ,0111I 11Heodd r'HE£EnOu
 NIOdn,LmniCH 9z%n'uj EH '(I) nUEL12e 11 (a) EH11J,Hattf 1111Ham/Cd£nd Nth' x 411101nxuH£oa
 'E103'a ICIIni XH3133h11J31CME '(9) 'iiooHxdaeuo olbbNi3EHJg,E931d90 EH o,Iah 01"EH EU 'ISHHahAlf£u
 0.I011d3£EU 11I.Id3He LLL3o1JA1.0 (E) Ea4ulcuNIU o.loHda£EU IJOOHeuOH3LHU I4NaiEdjnnt1
 3I41HaiK3de 3111U0I1SH3K0u lauauaEJatfadu g,.I114 EH '(HH31MJ, 150113E1'LL1E9Ed90 NIOUHx -a's.)
 1saH3m d£Ed as Euodou IIIOH11hul13u 11 IH31J, I,lo13naI^g.LEgnd90 aJ,aoHXdaaOU EH KFHahAu£H
 OJOHd3£L'U ol4.LaoHH11o11aLH11 'a'TUe(IINIU 1 11313ah1Ja2Cx31 oaalnoIAdudJaHaad 'E3IHN1and11
 oJOx3an1J,aiCxn Otl '11HE3J, 'g'.LaOHxdaau IS1NI331hA1190 1Sa1,31SUHls NII4do.Lox '313L 1£
 Ex1HhOJa14 J,o NIa1HISQJ331d:PIKEdO,LxEd) ISNIad,L Kaj,agu3tfaduO uxxcdall1£ Ho,Le EH11hIu3\$
 •11HEx,L Kahalmed£Ed 3UL'hEH o 0.Ialu0L aLZ 4Ifa.Lat(Hea 'E341MUNIH 0J03133hICLDA3 E
 NIa1HaifHK011 11 Ea4u/tl11U O.loHda£EU ISMH31p ff'oe IKO11EH31H afxcaPl Exxcdal(E£ KEHH3Nt3d1
 IS3.LDE1101U9EH a31h-Crto 11a1II90 a '3113hEH£ IsaH3HIAf£Ed x11 KUif 30Ni111OX90aH J,anmI4eadu
 o.Iodo,LO3'madam 'ISLIHahICHEI OJOHd3£EU OU0H3411/C111^I11 3191(f 1111ExJ, EH 11Ha,J,3 3tf£OH wJ

'11HE31, II10113EH14,LEgndg0 E1111X
 KMHauatfaduo 4Ja0Hdae0Jaotf 4JSIaIgaOu 'g LoomKONIcoa J,31lf a034U/CIIniH XL313ah11J,3kle
 avtaxau'aa ISEHg11Ed,Ln3no 11OfEd90 murex tux 56-58 .L0.L3Eh xr^gaoxAaf 33011011
 s OIH31111 OH411EN1H33ELY IS11HaII0HJ o 3LH3h31H£ o,Lh '0Ht111a EMH£Ca11d enq '11U311te 11 3H11.LHatl
 H xl4Nialcdudaua.I 'ao34u^gnwx XLI3130h11Ja/C31E eodL,xau3 tf&L111nrn3 K11Ha1II0H,L0 xu4EdJ
 1433CEdgo£11 1111'.1114 EH Aida 56-58 .L0.L3Eh xr^geoxdaf a3ouou a IsA,j a3tfO[119EH 'EHH,LII f
 11 111131116 IIHaul/Cd£Ed udu XIallOIE3111H£OH 'HOa411lCID'Uf X113133h11J,32CBE lfLLHifU1iE xi4H03114u
 3IUI11f£Ed 30HH3aj331II1C3 331109113111 O.Lh '33c313L 0HE£3131011 OHgueJ,11MIIId3113x6 LUhlEdO.LaV

'ILLH3L111EU KII^IHEd,L 140Hd3£EU 111111333HEH
 ISExa/Cu0tf an 'KLH3hAU£H OIU.IdaH6 11.L30WItfoX9oaH aEhAIfa s 4J,3131c11H3 4Jaounco11fOe
 .1331 t LUI31xJ H^gP Iana^gu.Egndgo um, stm. atfaduo o1xcoll o.IOdo,ox a1LLLFIn i^g 110110x1111
 Ou 'or^gH^g3J, 3 K11H3hA11£11 1111aL3 pt(O1i1E£e nth' O.I3tttOIEx11H£OH 'E34mt11N111 oJ03133hILL . ME
 11LtlEdLaLJad ullll3dauo 31gAf MaHExJ, 11MJ,09Edg0 9030113 s 311H3tt3aa 'NtofEdg

4da0Hxd3aou oIAN13EHI4d,E9Ed90 EH .LO[ISIcuEdIIEH 314113hitlf_gH 3oHd3_gEU 3OHa4UIt111VH
 'EH14S,H3t14 H11ENie 14HHamdd_gEd mdu xlluotux14H_gOH 'Eto_gut1NI14 xxaahlldattxa 1tLdLIIUUN13
 xIgHquudd,xy3ua x14aoxnu m xaxcdallE_g '111t,LHUUNIE x14aoguu HHH3haH_g ai4HHOICE.Le
 E4Hah/tOUU xEx o I0d 3lfOOII °HifeIne **Mitt** XI4IIHOIra Le aH.LOahE i H.LOI1tdI73)ai 'HICEINIC
 i Hamld_gEd mdu ouatuorexMucoa 'Ea_guXurtm 0.I03133hM, abrE I4tliLHlmNiE (3Ho_gEUUEHtt
 NIOHHE_gE31 t a) HOH_gUEdd,xaua 140140511411 H Hxxdatec I411Aa,Ilnu^gIE HOHOiHU ISHHahrHc
UX!56 Olt 98 .LO .LOS.oh 33ouOU H Ea411itIU'414 0.10x33na LoltxL' Ed,Lxauo AitiI 14ICIBYE
 ottaoxau .Lotuclaw_gH H EO4u/twn O.IOMOahH.LO/txE (3HHEaO_gEd9o3du-agdAtcp 'dalvaduaH)
 3HHEa0_gEd9oاد aon^c radxxaudo d,HtloacaodJ •Ea4uAAIU^cIH o.IoHda_gEi EIFehEH oH4uad,Ha0H,Lo
 Ea41161u~IH o.I03133haLo ^{3E} EIFehEH lt1131cdya1E_g .Loral ildltadup •ao^q ultuNU4 o.E03133hada4cME
 ALCEhEH LHH1HO1tHS.O,L2HJA00 'HHa_glada .LHMOIAI ,LoudazMH4 H 'e3auguilH 0.IOMoaha.I oA3Ia
Allmul n outaoxau doladaNN_gI/I ^oioxaaawudu NIHxO3hH,Lo&31i4HO_g 1.I0NI3Ehtt1190 H_gI411ga
 I414HHa)auouood .LOI/tdad.LOH.Iad 3^cutifl pNH 14H)IO3ha,L3tt31a .I.O.Le •34ulut is 1/I14M3ahH.L3tt311
 .Laaxaa_goa Hu rw nau3m td_gEd adf j •ttuahaH 0.13 aaluol aLO•L3H.LOOa 'auawada .LH31IOYsl
 ,LOLdmoxH4 H O4uttu is Hlgada_gEU .Lo Adad.Loajad NIH.Le 3 ouxa^cIadaoallp •I4ifmmle Eli_gEd_g_o
 o.Iol hoaodgaICEx 4.LOoxadaou ^otaBal%Lu ed90 EH d,otuuaedua 14xa1daoll oaa,allada
_g3dan 'IVoda_gEu Nu4H34ukmrn 3oJ 1aMadaHa,I '3HHahAu_gH 0.IO.Le aI3OII °EHII LH3t HUtf
 xIcHH01m.Le aad33he31 a ^c 11HIIEMHIIH4 3H,la!Podd,ag a d,otXda3xa41 °EHH Lu i HajamAd_gEd
 mdu o.I31noraxa11_gOa 'EagI im a o.103133huLlo c) E I4lit(u,arn QE (3HO_gEUUEHlt u' oui•E_gEaX
 a) 110H_gUEdd,313u3 HOHO311411 H HxxCdal_gE_g I4lttLHUUNIE 140HOx14U H14H3hEHc •Tj31 96 olt
 88 .Lo .LO.L3Eh 3aouoa a Eo41Ltu1^cIi oaoxa3h14,La[txE Ed.Lxauz Aicd,umir a oIttuOMHU d,olidaiY_gI4
 H Ea411faly a oJOOxahaadaXxa (3HHaaof_gEd9oاد-34dt0 'dayinduBli) 3aHEHO_gEd9o3du
 3o14UEdd,x3U3 .LHtloaf_gHodu & HHYIEd,L4I a4I 14 amiaao_gEd9o3du o.Ion4ICEd,LxauO 3x0119 \$
 •E34Ir u **NH** O,IoHda_gEU EIFehaH OH4u3,LHaOH,LO E3^c1r1m14 0.I05133hadatcME arfehaII Xxaadalta_g
 .LoiHuataduo H0UeadaLH14 XI4HH3113da HnH3d3Ni_gH 3310119 g •Ea4UttuN1a o.I05133ha.LOANE
 AuehaH aatuolttadadaad,000 'Hu 13d& .LHa1NOiv LotAdaax144 H aogiftuNai O.IOx33h14d a/t is
 ALGLHuuNIE oittaoxan d oaHdaNi_ga ^o i'i &LHICUNIE v_tHOauu NI313d,adaNI_gI/I NI0aaHNI3adH
 NI11313hHd ^{3ICIM} I'HO_g 11ONIaEh/tf90 14_gI411914 NII^cHH331O11O113Ed dAilttdad.Londad a411&&INIH
 11Hx33hada1txe d,O,Le •34uAIINEH H1431zahHd3AA31E daaRHH_goa EHH,LH3t1 HH3mAd_gEd adLI
 ItL[EH EH 0.13 IIHIIIOGtadadaLo3 '1113NI3da d,H3INON1 d,oAda3aa4 & HOUeadad,HH XicHH3NI3da
 HH13dbwt_gH 3310119 ^{of} H 34u~im'u v_Hcada_gEU d orAdaddaa,Iad pj Wodod,EddaH.13dodA4
ILLS 3 OHHa^cP13da0Hlip •EHH.LHatt En_gEd90 0.I011oaOd9HUEEx 4daouxdaaou
 01EYMa14d.E9'ed90 EH dAIHifaeduaH ^oMHH3HOMEH H ^o OH3OUGH 3Ox33hId,OO 30110IEhO131a
 ?, Hxaad.3ott oad31tad3 _gad3h Nloda_gEu NI14H34u4tuwa aoiaetaedadaHaj '3HH3hiAU_gH
 oaoxe 3830['Huewe HHHam[td_gEd Liiodou 3atuolttad,ad and oo3 'a14H3h1H_g aaluolEml4Hadu
 'j Ed_gEu HHhEdaH3.I HH,ld3ne 41t3aodit d,o18auuuauadait oao, e ^gulf -um,olllodd,olf
 Ed,xEdd, o.Ion^quJ,LHdaj_ga /txaod9Hriex xultoaodu NQauHahutu_gH Nli4Hda_gEU e9A_g
 gauaxd, xlgltadaad, Hxd o9Ed90 NIO11EhEH t13d3l •a9030u3 HHTia_gHread 14oud,adxHox danadU

'HHTiExHtiHH

eadavlodda t NNOttxa **od** H33FuHduo3 Hx33hadd xae tloxl4H a 'EMH11mH3adu 0.I03133ha LoAME
 NtttOXi4a 3 H3 Ifduo3 lax33had LM3ue o.Iodo.Lox ttxa IIodod a 'uoueada.LHH xi4HH3NI3da
 HHUadaPt_gH exou9 uotloxa_gH Naatio 3 HaxuHduo3 Hxzahad,Lxae t1oxl4a a 'Eda_gEII
 31011oxl4a 3 H35CHduo3 a 3had,uo edod.Eddaa.13dod,O4 ttxa NI3hIdu 'ol do.LEddaa iadod.o4
 ' aouBadad,HH xi4HHaPI3da Haa3daiN_gH x0119 ax{MEJ, E 'l HHIIExattHH as Lojod Lo
 INOttoXa 03 H 3 l HdII03 Hx33hadd x3us ttOXI4a E 'EMHHNt311du o.I0313ahadattxE ³¹⁰¹¹oXI4a
 a HaHwduoa Hxaahadd xaus ouodod ox t oxa ^o fiO34If(tmNH xM1OahId,Lxae I4ttA LH11nNtw
 goaoxuU 4ua.LHdap_gH ^o 99 **p** > eTT :oiaaoua^ct usiluoindoal uaott& ^{uo.L4} 69A_g

Eda_gEII .1.o HHHah1AU_gH Hxaadaoti Eadattato atiox11a um moo 150xa3nH.L110 NI3HH311'UEdIIHH
 a .1anuaad003 Hd30H^cIYalaadaalth YIOH9IIeNIH3MENI 0.13 aHHauHeduEH 0.Lh 'INO_gEd90 NIHSIEJ,
 Iy414HHOUaOHEd34t 'g xmlu^cI3Hdu UHx3ahHda/txe ^o MH1u13HOHEH H g OHXOUO1 30333hLd,OO
 aatuOleh011ixa 'ed3_gEu Ntoltogiga a HaMCHduo3 Hx3ahMd,uo o.lodo .ox ttxa 'z S9li_gx Ed_gEu
 a,o HHAanAu_gH odoHd3_gEI Hxaadaott 0adatiada 'j da_gEU ^gHE_gEHou adLiup EII ^og',I14~
 an au3uaa Lotiadu ouodod ox ENtaxa 'EHdaHoddatt ol4tuoutou 3 daNtaduan '11Eaocmuae3d 4d,I4g
 .La noNI HHHa. adgo_gH 14u~tNido~ ^ou ou 9o3ou3 1RI4NtaB11aIE_g ^o HHtrextiaa EHdaHoddatt
 Nlotfoxa Oa H33E{Hduo3 Hxaanlldd xae tiox14H a 'ti,ix 86-98 HHHa l3tCiiodu LiOaouou 3
8 Ha11add,4ua4I H HHUEao_gEd9oاد OJOH4ued,Lx3n3 xou9 _gadah ExaHNiaadu o.IOx3ahHdattxe

soma EHO_gEuENtf o.iowaunaadu EYINHEd.I^G IsKHxdag .i.aEini4aadu aH on-mod& ItLQOHell Ou IgHUOa NOHdEY(d N,LOOHauaEduEH 14NU'cEd.IENtf igHNdlunAuou aaHahiH_g HN.LHatif N mime EH KNH.L3Nat_gOa o.Ionda_gEu aoNlax{ad xL'd, LawEduu xi4Hhrn_gEd Ndu aoda_gEU xi4HaquCuNIN E.Ltdx o oxodx i **nut** •i4112CLNUUNia goaqueJINaME1"! **Oj** oiHaodA ou i411UOa NOxaahN LD~tJE NOHdul:tA N.LoOHauaEdUEH IgHINIEd.IENIt EHNdwu &uo EHauUGHE.La2t OH'TUE.LHamdauOxe NN[Edo.1.aV -v_ioxoahMdar]a x E3I_g14119 EHIOH KEx3 hN.Lalt E ISEH_gaIOj '(130 i OM3 hM.LUO 011 'a.L) 15NH3h[tu_gN O.IOHd_gEU iSNHaHEd.Laoduaed OINHauaaduEH PIOH%OHOUGHN.LOdu 'NNHaueeduBH a au.ld NIOHaua.L noxcA a Kax anad.l.aodu3Ed N LTOH113uaEduEH IS3.I.aauaa EHOUa KEHdAI(c•NHEx.L NNHamAd_gEd Ndu **u3YIIOIMIIHCOEI WHIMS** l, O3133hII.L3Itx3 0INH3HHEdo Ou N.L30HH39030.L33rfn EHIOH KEHdn [A O3E14t0 '11OH51CoJt_gOH3H Nxahaah.Lxadu ornad.Lavmad.o.Ia Ksualt 'Ea4UltuNiN O.IOxaahN.LDAIE O.IOH_g3110U AIISLNUUITe (cud **Oj** a oudaviadu) cud oJONH1 oa .LanIII4aadu n HHExx NONIanaI4.LE9Ed90 **minx J,o** .LNozaa_g 311 '11H.Lolah i zodaNl_gEd n o4.Laodoxa KaLauuu aduo ImIIOa aondeh'IC E1 **ALNUIN V** 'EHUOS ISExoaha.Lattxa KenduliA.Laaxr coo Alah 3.LE.L^qu4t_gad a '014.Laodoxa L_Toaox/ta_gxdadaa oo axA1_gOa a uai.oig nad.Laoduaod I471N.Lolah ILLS **IMMIX** 01HH3hX11CHI AaoHda_gEU Ahad.Louau .LiSa0HI4a NiaNHauaatt NINxoaiga **troll** I4_gE.I 3I4.L3d.Io_gEd •3NH3dauau n aaHamAd_gEd aoHha.LOEH **xN** .LN' Oxoao_g[j •dA.LEdaum.L xaoalga Oh' KaLOiEaad.Io_gEd E9d_g NHEn.L **oig**lidaa.L amiAIaaaI.I.LE9Edgo EagUltuWN o.loada_gEU NiaIH.Laigatf tf0[j

'ivahuxialuaa a xyloxaaoa E1lodadu x/[•NHEn.L 13auom td_gEd o onHaH.LoSladaouaH 314IanE_gKa3 on 'I4aquAi m 311313h11.LOAAME .LOIEnaHEOH 'OxaHtfO **IMMIX** ax.Lo9ad90 adjj •NOa'uAINN Nli4Hda_gEU NHEM.L NNHamAd_gEd Ndu o111110IExrH_gOa '14aglsfunm oa3133hz.L3ACxa **q** waaodad.I.Ozjad ONIN1(Ox903H NHEa.L **IIo** oaaIV.LEgadgo oua.L 0 ||| NIENIdo4 HN KNHah/ 11011 **Kut**(

'NHEM.L aONouals E9Ed90 au.N.L 0 L1aN11ENIdO~HN a NNa.L3•L3H.L003 H EdocaU 121111Ed3nal NoN.IdoHc ISNHauHEdIIA oz4.LooHwONi_gOa Ka.L3EHNh3UO39O NIONHah/AU_gN Nu4Hda_gEU Eg.g_g NOHEM.L xi'ldaa.L 1/1a,1,0gad90 IgdaLalloodu 4.L3OHaiIIO_g3g 'HN.LHo 1 MEx oBh/tua NIOHHN.LOdu **S** 'gIBNIe aEx .I.OIIoSualtaduo EgA_g YHExa. oIA 1doi. oanaeai4.LEgad90 o.L 'OHHaU.LaL3a.L00a EHN LHatt N NIENIE NHH31ILtd_gEd NIOHda_gEU Ndu xahioi xNH_gOH 'ao o tIYIN xaxaaha.LoAxa xaxtdatfe_g KNHahaH_g oI4HHO11B.Le 111 '61 3tf.I /('1 + ¹) < 1 :olnaouoA .LaKdoa 1 airH0li/C ¹ EauqAUNIN o.loada_gEU oH^qua.LnaoiLLA Ea4|||AInaN 0.I03133ha.Lalt3IE Exxadatfa_g HEHHada^{!g}N 11I1a3 'oahAII N.I.O.L \$ 'EHN.LH31 'N H UENie xaxcdalfa_g NNIKNHahEH_g NNI4HHO1E.Le 3 33 LAIEaNHHEd9 •HHEM.L NNHautd_gEd **nth** o.131110IEnuHEOH "ea^q**uAI1H** o.loxaahn.LOAxe NiOUEhaH N EaeuAuKN o loHda_gEII NIOIIHahaH Allman 1C.Inedaltec .LOIhdONI_gN 'EUahaH 0.13 wiioi ON1 .LOIAdaaxxc N o4uiuNr viqudacaU .LoLCdad.Lau.1ad Edoved.Loz.Iado.Lo4 oi\$HON on o E91t_g NHEa.L VOP1oaa14.LEgadgo Eua L IcauOHHo.Ltt KUTj

•HN.LHatif xux - aahAua N1oHHNxodu a '4uaN1e aEx .LOIKuattaduo Egd_g 4HEx.L otAdaa.L oLANiaeai4.LE9Ed90 oa. 'oHHaH.LaLaa.LOOa EHN.LHatif N Hume NNHauHEdEd nonda_gEU Ndu xNluoiaxnr_goa 'HOaqua/tuNIN xaxaahH.L3A Ed.Lxaua I tf t.LNUIUP 1coaoxau ISNHahaH_g oKUnHOUB.Le- **uS** ¹⁶**g** atf.I **'?,/aS+6S>S** :ouia0113A .1.aisdoa.Lauaot(A **g**)I,jx ²⁶ **Olt gg** .L0 .LO.LoEh 3o0uou H ao irAuNIN O.IOxoahN.LOAxE Edxxaua ullAJ-NUUNre uvoaxau ISEHHadaN_gN Nuaa 'aahlt D 110.L \$ "eHN.LHatif N NIENIE Kull Ed.Lxauo tfLi,nums a xi^gaoxxw NI1KNHahaH_g 11P119HOUe.Le 3 33.1,0WaHaad) 'li,jx ²⁶ 011 **QS** .1,0 .LO.Laeh aamion a Ea^q**uSu** i 0.103133hN.LoAxa Edxxauo I41fLLNuNNre 311113hxHE (3oH4II8NIN33MI) ooaoauin .1.0I1fd3p1EN **N** Eo **IrA W1H** 0.I031o3ha.LoAaa oNHEHO_gEdgoadu eon4UEd.Lxaua xisdoa_gNOdu mum. I_gONiaEHI4LE9Edg0 Ena.L ISNHoud ioduo N.LOOHdaa.O.L301f K'IH3MIgUO U Kut(

ni LHalf xux auhkia Niofax.Lodi a '4UENIE xux .Louxauattaduo E9tte **sum's. oIA** tdoaz. oLtNlaaaI4.LE9Ed90 oL 'oHHaa.LaLaa.L000 EHN.LHatif N NUENe NNHauHEdEd rioxda_gEU Ndu xaniO1ExNHEo a'aoa **q**u/Cium xxxxaha.loAae lettAs unn' a 'joaoaa KNHanaH_g aIgHHOUe.L^q **vd** ¹⁶**V** attl 'z,/(t(y+'d)>V :o1NHOUa& ..andoa .auaolla **a** Ea^quAluu o.loxooha.ia.CHE uh'Lli,Num a issaoxiu isauuadau_gN 111133 'OehlAI3 N10.L •EHN.LHatif N NIENIE Kutt til~LNUUNre xu4HOaxu NNIKNHahBH_g NNI4 naoue.Le **3 03** LOIEaRHHEd0 N Ea4UAirIN o.IOxaahw.LoAae o.IOHHHEli Al/tLNUUNIE oLtaoaa 3,011fd0Ni_gj/j •NioxH3h411_gN N114Hda_gEU E9A_g NHEa.L giotfdaa.L NNHomAd_gEd Ndu \$INIncrexNH_gOH 'aqrAn is NNxaaha.lo/txE .I.OLCdad.aa tad •Eg/C_g NHEM.L Uolidaax

IrEH.Im3 **vllrtx3ahNd.Lxaue** a xaLatteEdgoadn **rvoxmhVVamdu** IHmM3 hm LOtjjE **o.Iovva1dlad.LJI1Jad**
 E34UAUVMm 0.I0313ah11J3/CNE i^**IOLEhEH** m rvodosuedJam,ladO.LOII oJorlaAdmd.LJLI,Iad E34u[Cm m
 oJOHdacElr nOUEhEH IClixcaro Excdalduc aoireada.LHm xi^HHaraada aua.Ladaa4wa atfoxr a
 11FI ^g ExmHNlamdu 0.I03133hLI.Labre N1o1 OXI4a 3 HaWWISduO3 Y13133hwd.Lx3ue aOUeada.Lllm
 xIgfHarvada Kua.LadaNEa 1foxa v1Odo Lg •91-60 **Etrnd.JODUml3o** o,looad4 a i 3009 EH
 6 aOUeadas,Hm xi4HHanada aua.Lmdarzem aoltoxa em nullo 3 **Iu^amaxclsduoa mxahyld.Lxaue**
 m j 11daeBU' Piolfoxtga 3 **Nf^uHaxzdu03 Id3133hH.LUO** 'Kr((D 11t0m1'0J04) **acEg EH** 01
dos,Bdaam.IadotorI a.umedatto3 onIra.LVIHUOuoh oaLo od,L3A **ax[x11y** •9 **Edo.Lxa.Lat1** oaoaoxuu
 Ntolioxa 03 HaxclSduo3 **ux3ahad.Lxaue** 11Oxi4a u 'g ExrnNamdu o **lox3ahLI.L3ttxE** IYoltoxi a
 3 H33KISduo3 1113133haldLB3Ue 1foxa o.Ia o.Lh **NOEEdgo NIL13ML LII4H131E0H11J31C** '988 'j^g.LNI
Edo33aYIodu 30119 11H jzgnii aocalread 11 **a4dA(p** ala **Iraocudgoadu** aod.L314g amtnoLCe^g uou3u
 g E03gLa11111 **xux33hvid.Lxaue** mmt ud.,^gum u auxuaocEdgoadu **o.Ion4IIEd.L31au3**
 mom).Lmicdatfo3 OaJarlodJad oH4ua.LaH1r0II0 'da,a^PL4uo a vjoaodljvtn HEdgiga oaoodo.Lox
 3e.1,33h113I E **G N1od0LEMN1tH12** 3 9 (do.Lxa.Lalf Yugao rnn) a34utCuvam **xUxoahud.Lxaue**
 I41 AJUUUVV1 150E0xmu qua r.,ndaNIOa eadan Ha aduo3 **aMDahud.Lxaue** EH(40thn 13oxl^g
 o8Z Uo.IA AgAc **EdacEU** LO KviHahtcucVI HxrE.L30ti Ee.Ia11ad3 ailiox4s EH aoo **II0x0ahILLllo**
 rva11HoUaBdLI11H 3 **L31SUHE.L303** u.L30H4ud.LI4H.LOaAh **lUGH4lfNeNIm33ren** o.Ia 311HalcEreduEH
 O.Lh 'NOCEdg0 mom. **r,if^uHauaonu.Lo** '881tw8g mxden1g Ho4 odxNNI HaWOrlomard
 14raa1ana vlatnolAdm fulof, **avx4HhaHOEH u** ;50HHaxcoL1OU3Bd E3A310q oJOH1 eC LO **Ivly** g|,
 maHKO.L33Ed **'Edacut** i oltoxI4a u aaxcudu0 1/13133hILLUO **JHHahi ifcu** vlx11J,3011 Es.L311ad3
 Ifoxa 1lmx3ahm.LUO Nlahmdm **rave** gZ l^4aUHISO.L3aud ru Ha&xo(p 3 Am.1,ono **oiAnoIAdI43Ax04**
 o.IaYIIExcdalfoa E31mHh3HOx1111 m g .EHMOUo a.maodm4UEa Excad.LO **xi^uHaxciduoa**
 1113133hm.LUO &MO a0131110111411 Z A91Ce x 'edDEEu Lo **umnahAucm** mxsE L3o1f oasallad3
 •18[10:J,101,1 EH j **dacalr** r14no icAunu Hudgi4s uaHahAClrcm E31aHh0.L314 as.LahEM g

•**NlalnaAValra** s.Lmo.Iao3 Es.L3vjod.LoA ouovvauuatetc aaaEeutread **r_foHS,adxilox** davmdu

L 11mtExm1tHm aaLouod.L31C NIOI(Oxa o3 Haxcaduo3 mxahmd.Lxaue
 1foxI4a a g Exmlunaadu oJ0x33hai31CiE wo1 oxzga a **Ha3ia}duo3** mx3ahmd.Lxaue **oJodO.LOx**
 lfoxs Hodos,s 'aoueadaLHa **xi4HHaraadu** umnadaraem ExoLlg aoltoxa 0m 14IaH1111 3 Haxcdnoa
 mxoahads xuae tfoxl^g a u 'j adaeau lio (oxi4a a **Haxacduo3** 11x33hm.L110 Edos,Edsam IadosAtp
 1toxa **Ptahadu** '01 dos,Edsam.Iados **of** m **6** aoumsdasmu xl4HIIaviada anuadawem
 xoug (Taint, 'no) smxcdalfoa on^gIraLmuuou0f os.IaaodaoA **unna.Ladgoem** I4ir ANldo4 g•u ou

oaoaoxau Noltoxa o3 **Haxcduo3** rIxoanads,xuae 1fo3I4a 11 'g Exml'lamdu o.101133hm.L31Cx11
 rvottoxlga 3 HaxclSduo3 mxoanudJ,xaLle 1foxo o.Io os h 'No0Edgo ramxaJ, YI^q uHaUaOHBJ,3X
 '11,jx 86-88 ISUHExaAuodt ao3ouou **3 8 maTlada,qum4** m **uauaaocadgoadu** o.Iongiads,xau3
 310119 (ja•.Im4 'v3) smxcdalloa oH4uas,mxarouolf oaL3zodJaA umuaJ,adgoem I4IrANldo4 g•u ou

L, a 'raxmtium raoaLoaOdJaA 3 H331cgduo3 mxoahmd.Lxaue **9 do.LxaLalf**
uI4aoxmu 0adah Exmurvamdu 1(oxt4a a ornuornoa too3 /Cwrovauauua0 r Im1nousdoaJ,auaolfc
 ^UOLC **AgAc** x adacaLc J,o u11HahAuem mx11J3otf EEJa1fad3 Aroma EH moo ijOxaahms uo
 NlaaHoLlaaduH 3 .LoISUHE.i303 I&LDOMu2.Lng.LoaAh **g on^uenn3xary** o.Ia aunaauaduEH
 OJ,h 'NIOcadg0 ramxBJ, a aoaE.L3/C g xmluaamdu 14aMo3h11JaAC11d 17 aHHhoHOiEH m
 BHH0ua0.10x33haJ,uo xoead,Lo ar'mHa3mououaed OH4ui.aa0 aL130U NrlilnaacdattO3 Z icg1co
 x Edacau .Lo ISmHan/ar m maEaJaotf Noa 1 tfad3 03 Haxcduo3 mx3ahm.LUO oaodos ox tfoxt4s
 'j dacalr IaI4H34i[tClrv (8%114 'pm) J,Hmalatfo3 oa aodja/C amxasadgocm I4uAndo4) js •u

•JoxaoxmdL,m afU0axou
 OH110I(31C **9-g.114~** EH Examioadu o.I03133haLo as HsaoaaauaadHEH ENII'11L'd.IEH)1 •1multoc
 110MBm3d u11HaxcaLoo (raa11EOU3/C NII4rvmtioxgoaa IS3.L31SLI3U ' 098) p) OTT :oiaaouag
 LIimtnousdoaJ,auaot/C 'D LIO.LC **Agile** x Edacair JA ISaHahICucH i aaJa01f EaJaltad3 at(oxI a
 EH 1130 IaOx3ahm.LU0 K212H3LIaadIrEH 3 J,3auua.L303 m L30H4ua taa LOELgh 11OH4uEra113311NI
 0.Ya amuoLcaaduEH OJ h NIOOEdgo ramxBJ, Ulgh113IIEOH11J3/C xahNlamdu Hmx33ha LoAxa
 o.Latnexadlfoo 'Eajar_IodsA u11txddJauox mmua Ladgoe11 raatxaosau a aaNaauBulladu
 'IaOcadgO wmaBZ '11ua L UO3133haJ31Cx11 YIa1mHada ao.LoaLCdtfadu o98 1100 I-IOB33has,u0,LO
 Bxaawamdu 0.I03133h11J31CME 11J OOH^gIra.LaE.L3H&h goa^t uawaoaaw uuHauaeduau IHHOH0LIMLO

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НМИИwTy,ga КОТОрОГО npOHOpIHOHanbHa BeJI P4HHe BpeMeHHOLI ЗагерЗККН. Bblxo,q ,LI3MepHTCnH BpeMeHHbIX HHTepBanOB 9TleKTpH^LieCKH COnpA2KCH C HHJ KaTOpOM 7.

ТайНМ образоМ, На ОСНОВАHHH BbIIIell3nOIKeHHO!O Зас rmeMas COBOKynHOCTb прН3HaKOB B способе H ycTpoilCTBe 17O3BOn\$CT peIIIHTb Зад а¹ly, а HMeHHO CHH3HTb OnaCHOCTb HaHeCeHHA TpaBMbI nau, eHTu прН паЗерНОН обрабоГе TBepgbvc TKaHeH Зуба прН neueHHH KapHесa H проТe3HpoBaHHH.

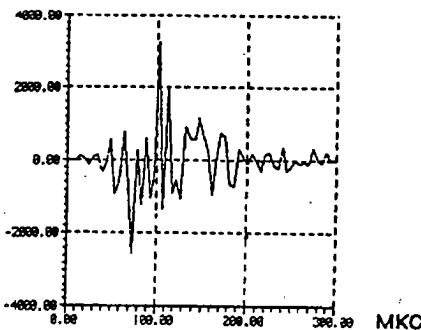
Claims [OopMyна x3o6peTeHHsr]:

- Снoco6 oбpaбoТKн TBeP)бIX TKAHe&i 3y6a na3epHbIM K3nytleHHeM, sn iiouaioBugi B03AC CTBHe Ha TKAHH 3y6a na3epHbIM HMnynbcoM, oTnHlaiOIIj II CH TeM, uTo pernCTpHpyIOT aKyCTa ICCKHK HMnynbC. B03HHKa7On;HlYi npH B3aHMO)lei cTBHH H3ny*aeHHH c TKAHbIO, no nHKOBOi airuiw iyje KOTOpOPO onpeirmnoT Tnn oбpaбaTmBaeMo2 TKAHH.
- Снoco6 **no n.1.** oTnn'lalonvelftCH TeM, LITO aKyCTH¹leCK1II HMnynbC pCIHCTpHpyIOT B jjnana3oHe 3ByKOBBIK¹laCTOT **85 95** Krij.
- Снoco6 no n.1, OTnn¹iaJOn;uiCSI TeM, HTo OjjHOBpeMCHHO C perHCTpaIjHeik aKyCTH¹ICCKOPO HMIIynbCa H3MepHIOT BpeMeHHyio 3ajjepitxy MeicJ y na3epHbIM H aKyCTH¹leCKHM nMnynbCaMn, nO Benn¹IHHe KOTOpOLI yTO¹IHHIOT Tin 06pa6aTbIBaeMOId TKAHH.
- YCTpoi c'rBo jjni **oбpaбoТKн** TBepjjbzX TKAHei 3y6a na3epHbIM H3nyueHneM, cocToHnRee B3 noenejoBaT2nbHo pacnonoiKeHHbix BJ;Onb OIITH¹leCKO2 OCH HMnynbCHOPO na3epa H spejicTba) OCTaBKM i3TlyueHH51 OT na3epa K 3y6y, BXOjj KOTOpOrO OnTH¹ICCKH CONpi7KeH C BbIXOjjOM na3epa, oTnnualonjeech¹rem, ¹ITO yCTpO2CTBO CO) CpxiHT axycTH¹lecxn171 npMCMHHK H H3MepHTCnb nHKOBOLI aMnnnTyjjbl 3nCKTp1¹ICCKHX MM IynbCOB, BXOjj KOTOpOPO 3nCKTpH¹ICCKH CONpHJKCH C BbIXO,j OM aKyCTH¹leCKOPO IlpneMHHKa, a BbIXOjj 3neKTp11¹ICCKH CONpHnKeH C BK0140M ycTpoiCTBa HHjjHKAu,HH, npntieM axycTnuec ii npHeMHHK yCTaHOBneH TaK, ¹ITO HanpaBneHHe ero MaKCI1ManbHOLI LiyBCTnBTenbHOCTH COCTaBnHCT C HanpaaneHHeM OnTn¹leCKOLI OCH Ha BbIXOjje spejicTba jjOCTaBKH 1113nyueHHH OT na3epa K 3y6y yron a, yjjOBneTBOpHIOnjvl ycnOBHIO II ° d < Ss ° 5. YcTpOIICTBO no n.4, oTnnuaionjeech i TCM, ¹ITO BXOjj 113MCpHTCnH nHKOBOYi aMIITIHTyjjbl 3neKTpH¹leCKHX HMnynbCOB 31ICKTpH¹leCKH CONpH?KeH C BbIXOjjOM aKyCTH¹ICCKOPO IlpneMHHKa Liepe3 6noK CneKTpanbHOPO npreobpa3oBannn n 4 HfblTpajnH C nonoco I npOnyCKaHHH **85 95** KN.
- YcTpoiCTBO 110 n.4, oTnn¹alonjeech TeM, ¹ITO OHO) OHOTIHTenbHO COjjepiKHT (DoTOpePHCTpaTOp H 6nox H3Mepenrin BpeMennbix HHTepBanOB, npnueM BXOjj (4OTOppePHCTpaTOpa OHTH¹leCKH colipHxieH C BbIXO) OM na3epa, a BbIXOjj 3neKTpH¹leCKH CONpH?KCH C OjjHHM 113 BXOROB 611OKa 113MepeHHH BpeMCHHbIX 11HTepBaTIOB, BTOpOYI BXOjj KOTOpOPO 3neKTpH¹ICCKH CONpH?KeH C BbIXO) OM aKyCTH¹leCKOPO npneMHHKa, a BbIXOjj 3neKTpH¹leCKH conpHxcen c BXOJZOM yCTpOLICTBa HHj nKauwH.

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Drawing(s) [~lepTemn]:

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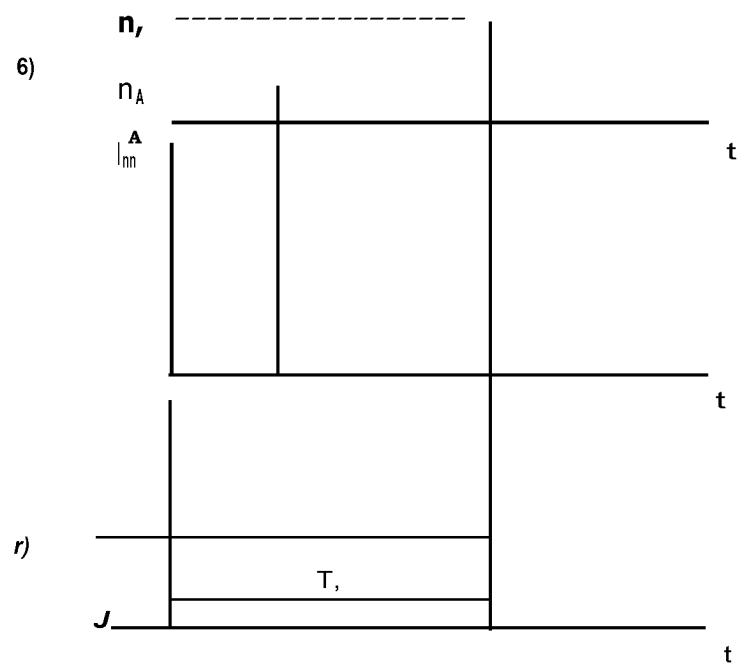
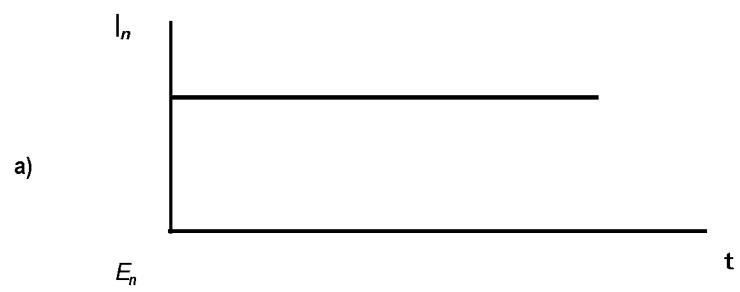
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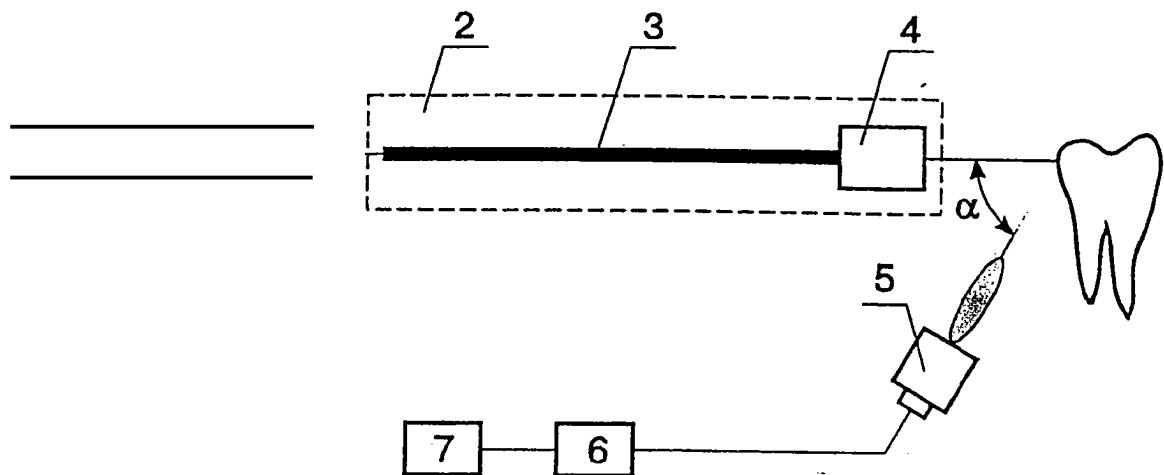
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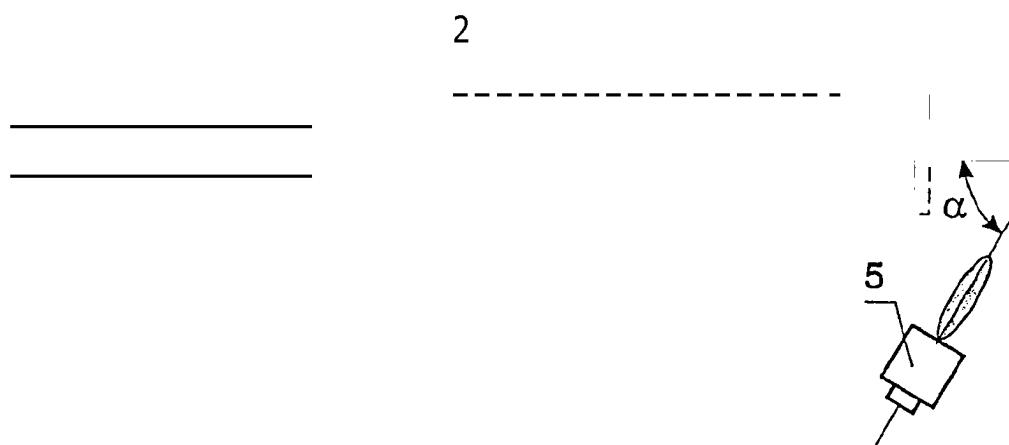
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